

Community-based Services that Facilitate Interoperability and Intercomparison of Precipitation Datasets from Multiple Sources

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ABSTRACT

Over the past 12 years, large volumes of precipitation data have been generated from spacebased observatories (e.g., TRMM), merging of data products (e.g., 3B42), models (e.g., GMAO), climatologies, field campaigns, and ground-based measuring stations. The science research, applications, and education communities have greatly benefited from the unrestricted availability of these data from the Goddard Earth Sciences Data and Information Services Center (GES DISC) and, in particular, the services tailored toward precipitation data access and usability. In addition, tools and services that are responsive to the expressed evolving needs of the precipitation data user communities have been developed at the Precipitation Data and Information Services Center (PDISC) (http://disc.gsfc.nasa.gov/precipitation or Google NASA PDISC), located at the GES DISC, to provide users with quick data exploration and access capabilities.

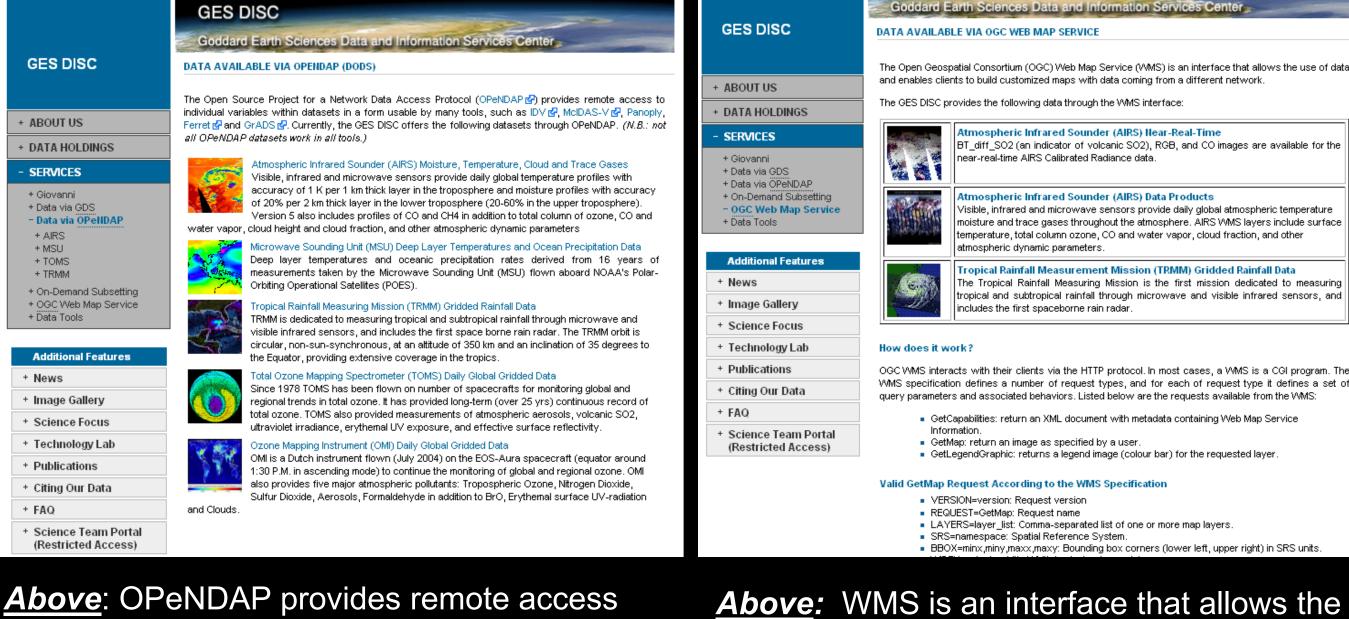
In recent years, data management and access services have become increasingly sophisticated, such that they now afford researchers, particularly those interested in multi-data set science analysis and/or data validation, the ability to homogenize data sets, in order to apply multi-variant, comparison, and evaluation functions. Included in these services is the ability to capture data quality and data provenance. These interoperability services can be directly applied to future data sets, such as those from the Global Precipitation Measurement (GPM)

This presentation describes the data sets and services at the PDISC that are currently used by precipitation science and applications researchers, and which will be enhanced in preparation for GPM and associated multi-sensor data research. Specifically, the GES-DISC Interactive Online Visualization ANd aNalysis Infrastructure (Giovanni) will be illustrated. Giovanni enables scientific exploration of Earth science data without researchers having to perform the complicated data access and match-up processes. In addition, PDISC tool and service capabilities being adapted for GPM data will be described, including the Google-like Mirador data search and access engine; semantic technology to help manage large amounts of multisensor data and their relationships; data access through various Web services (e.g., OPeNDAP, GDS, WMS, WCS); conversion to various formats (e.g., netCDF, HDF, KML (for Google Earth)); visualization and analysis of Level 2 data profiles and maps; parameter and spatial subsetting; time and temporal aggregation; regridding; data version control and provenance; continuous archive verification; and expertise in data-related standards and interoperability. The goal of providing these services is to further the progress towards a common framework by which data analysis/validation can be more easily accomplished.

Interoperability

Services are available at GES DISC to support data interoperability:

- OPeNDAP (http://disc.sci.gsfc.nasa.gov/services/opendap/)
- NetCDF conversion : on-the-fly for some datasets
- http://disc.sci.gsfc.nasa.gov/services/NetCDFConversionforIDVandMcIDAS-V.shtml)
- OGC web map server (http://disc.sci.gsfc.nasa.gov/services/ogc-wms/wxs-ogc.shtml)
- Data read software and HDF tools (http://disc.sci.gsfc.nasa.gov/services/tools/tools.shtml)



to individual variables within datasets in a form usable by many tools, such as IDV, McIDAS-V, Panoply, Ferret and GrADS.

Available Services:

Available Services:

Download via HTTF

Convert to NetCDF

NetCDF, KMZ) and spatial subsetting by parameter.

Convert to gzipped NetCDF

Merged 3B-42 and rain gauge estimates

Subset Spatially and/or by Parameter as NetCDF

Above: Mirador also provides data services for format conversion (e.g.,

Convert to KMZ Download via HTTI

3B42: 3-Hour 0.25 x 0.25 degree

<u>merged TRMM and other satelli</u>

3B43: Monthly 0.25 x 0.25 degree

All services can be for GPM. New services

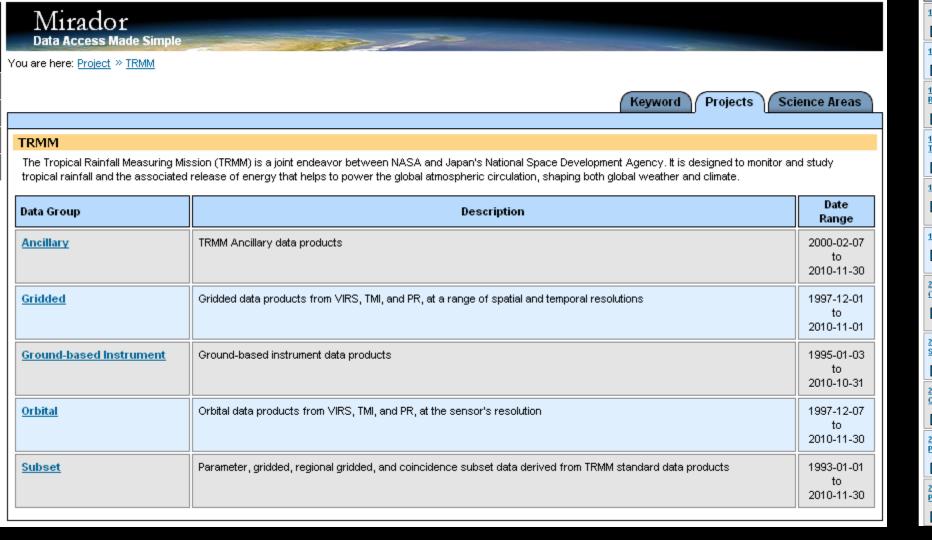
use of data and enables clients to build

different netwo

customized maps with data coming from a

applied to and enhanced can be developed as well,

Precipitation and Other Datasets from Multiple Sources



Precipitation datasets (left):

- Standard TRMM products
- Ancillary products (e.g., merged IR)
- Ground based instruments
- Other precipitation products (e.g, Willmott, GPCP, GPCC)

Other data products (right):

 Other remote sensing products from different missions (e.g., AIRS, A-Train) Modeling products (e.g., MERRA, GLDAS)

Above left: Precipitation products in Mirador (http://mirador.gsfc.nasa.gov/). Above right: TRMM orbital data products.

Precipitation Data Product Intercomparison and Exploration

http://disc2.nascom.nasa.gov/Giovanni/tovas/

The ability to compare precipitation data products from multiple sources is important to understand differences among products and improve future products. The TRMM Online Visualization and Analysis System (TOVAS), as a member of the Giovanni family, can provide customized analysis and more for intercomparison, comparing to existing similar services.

Giovanni allows a quick and easy access to visualization and analysis of NASA and other data products without data and software downloading. With Giovanni, users can conduct investigations using data from multiple sensors and from different sources.

TOVAS and Giovanni can be applied to and enhanced for GPM.

(Data End: 2005/12/31)

Atmospheric Instances: A-Train along CloudSat Track; Aerosol Optical Thickness Measurement and Model Comparison Daily and Monthly

Tropospheric Emission Spectrometer (TES); Upper Atmosphere Research Satellite (UARS) Halogen Occultation Experiment (HALOE)

Ocean Instances: Ocean Color Radiometry (SeaWiFS, MODIS, and derived and model products); Ocean Model Daily and Monthly

<u> Aura HIRDLS</u>

.DAS Monthly

RRA MONTH CHM

elect two parameters for any Plot Type of inter-comparsion To de-select a parameter, use Crtl-Click.

Time Series, Area-averaged

<u>IS:</u> Overlay of Time Series, Area-averaged

of Earth science remote sensing data without having to download the data

System (TOVAS); Global Land Data Assimilation System (GLDAS) Monthly.

<u>qua/AIRS Monthly</u>

RES (FM4)

ODIS Monthly

<u>cean Model Monthly</u>

If you already know which instance to choose, please select it from the table below

access a Giovanni instance, click on one of the four categories below

Partnership Initiative (NEESPI) Daily and Monthly

Overlay of Lat-Lon Maps : Difference of Lat-Lon Maps

End year | Animation, Lat-Lon maps

Time Series Plot | Scatter Plot, Time-averaged

2005/01/02 - 2005/12/31 Radar Rain Data

OVERVIEW

Giovanni

Users Manual

Publications

Newsletters

Feedback

· Giovanni Parameters

+ Giovanni Plot Types

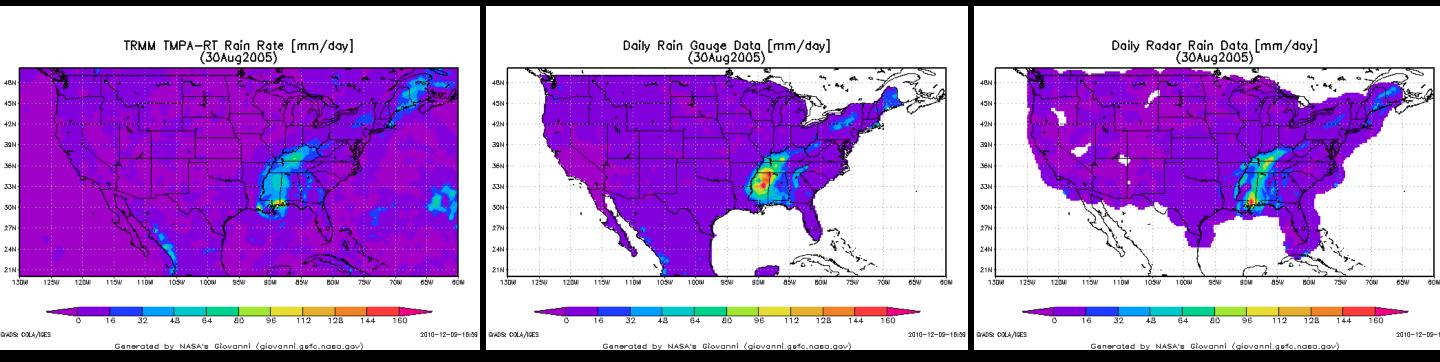
+ How to Use Giovanni

How to Acknowledge

Acknowledgements

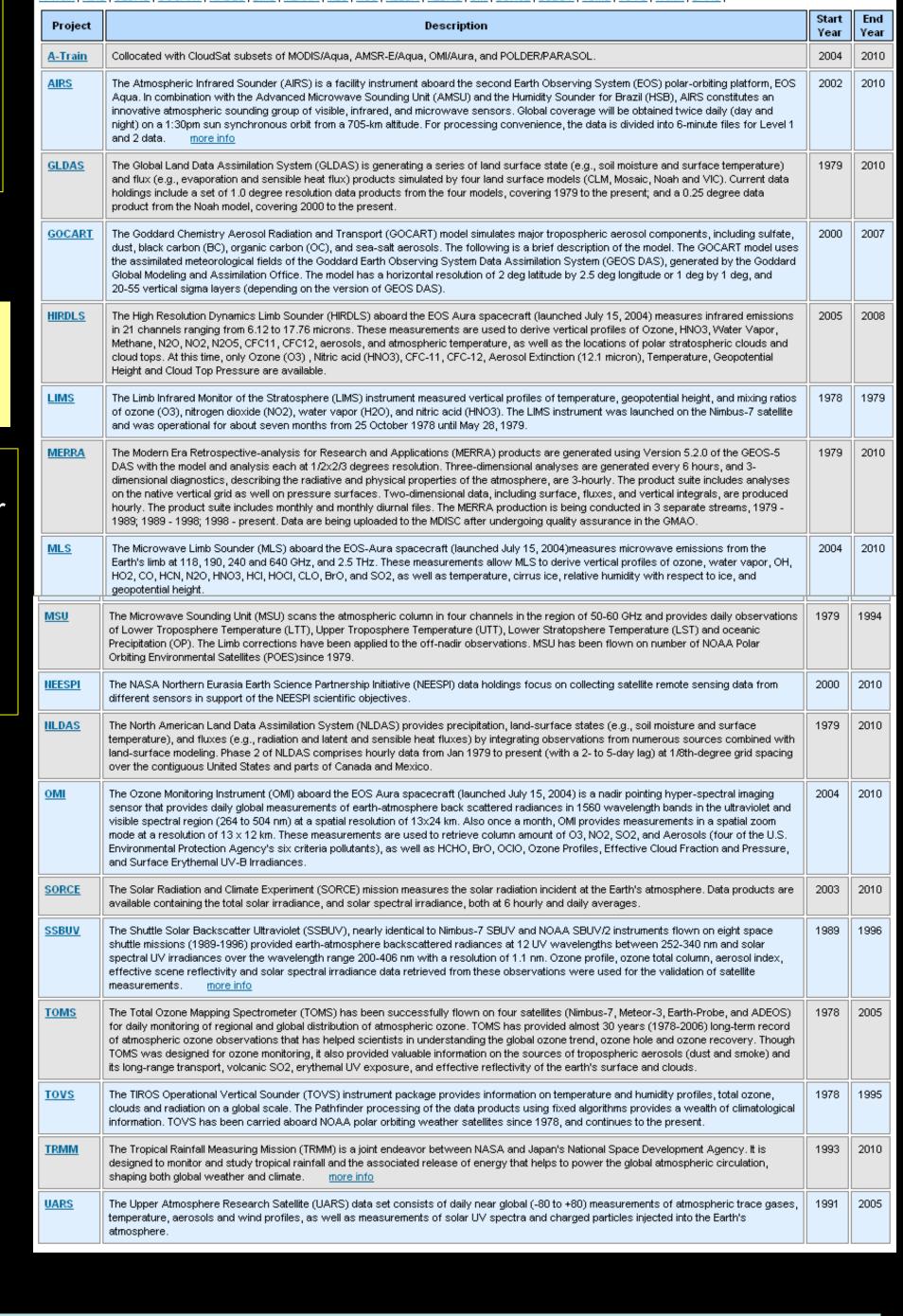
Additional Features

<u>Left:</u> An instance of precipitation product intercomparison. Three products from different sources (satellites, radars and gauges) are listed here. Functions that reveal their relationships are listed as well. More precipitation products can be added as well as additional functions or algorithms, such as those used by IPWG members. Instances of products in different temporal and spatial resolutions can be developed as well

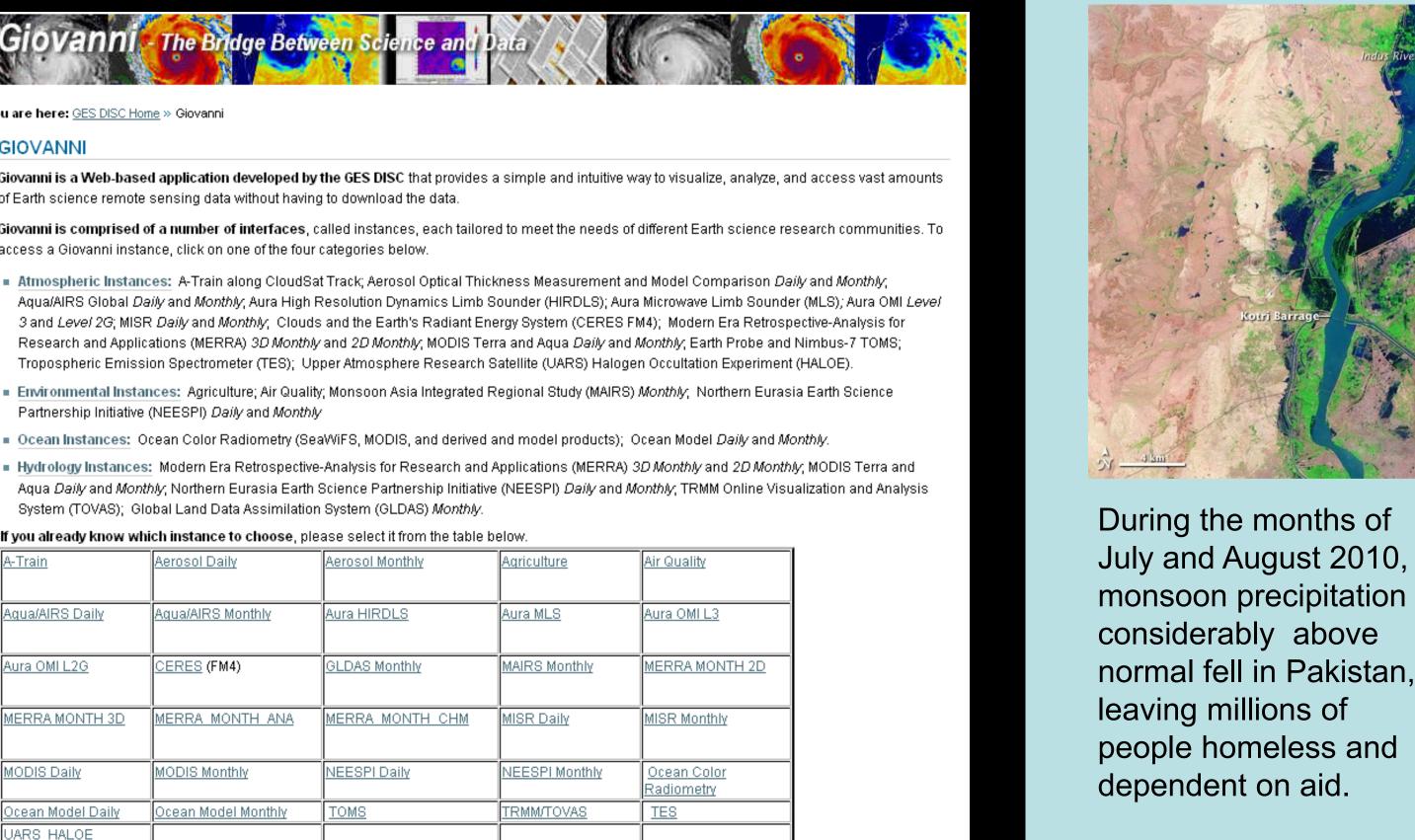


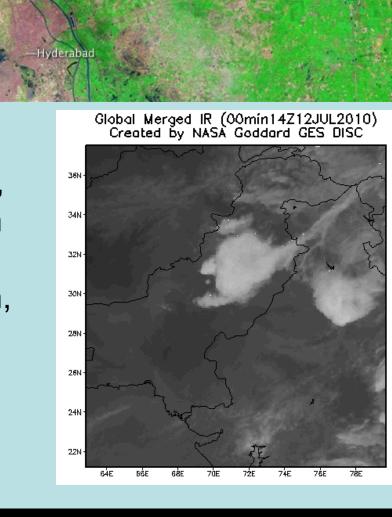
Above: Examples of the daily rainfall intercomparison during the Hurricane Katrina event.

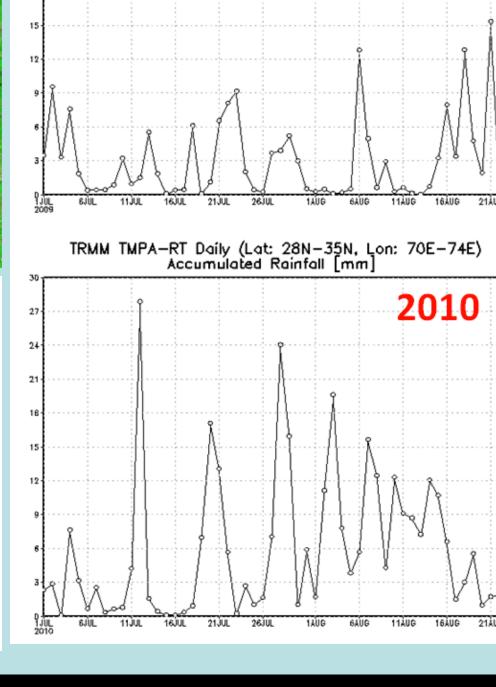
Below: A list of other data products from NASA satellite missions and other sources in Mirador. Mirador is a search and order Web interface developed in response to the search habits of data users. It has a drastically simplified, clean interface and employs the Google mini appliance for metadata keyword searches. Other features include quick response, data file hit estimator, Gazetteer (geographic search by feature name capability), and an interactive shopping cart. Value-added services include data format conversions and spatial subsetting for limited products.

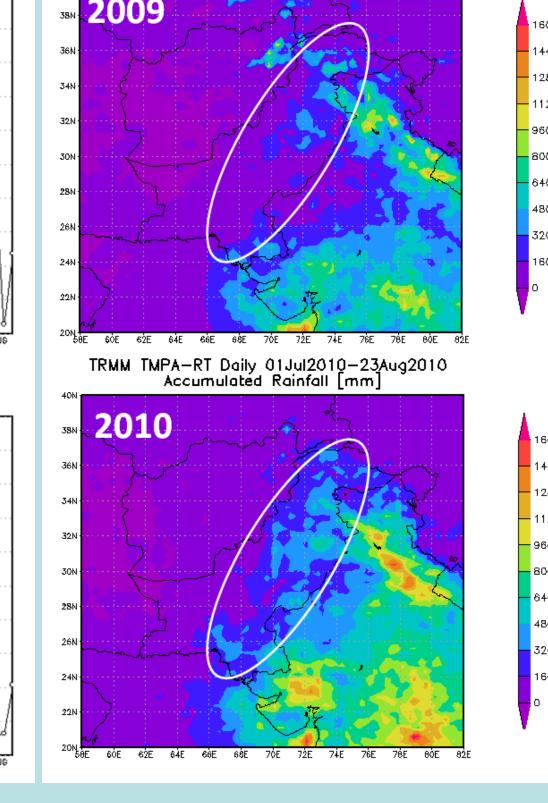


Flooding in Pakistan caused by above normal monsoon rainfall









TRMM TMPA—RT Daily 01Jul2009—23Aug2009 Accumulated Rainfall [mm]

Above: Other Giovanni instances containing many products from NASA and other missions/projects.

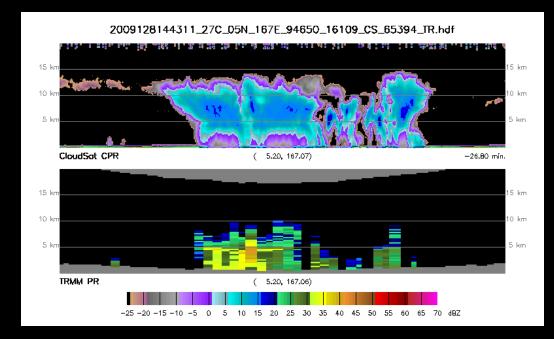
<u> Aura OMLL3</u>

<u>RRA MONTH 2</u>

<u>3R Monthly</u>

<u>cean Color</u>

Future plans include continuous improvements and new additions of data services, documentation, data application case studies and user services based on user feedback and future mission requirements. Emphasis will be on merging, integration, and intercomparison of multi-satellite, multi-mission and multi-sensor data.



Left: Radar reflectivity of Cloudsat/TRMM intercepts (courtesy of the Cloudsat data processing center at Colorado State University), showing data from two different radars with different frequencies